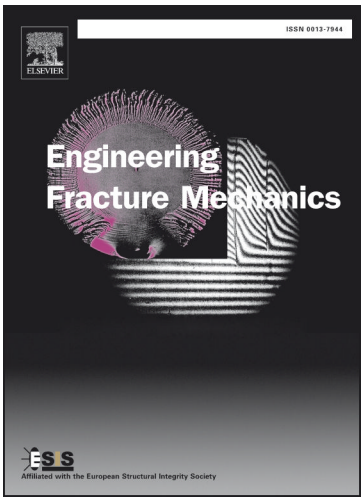

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A novel experimental procedure to reproduce the load history at the crack tip produced by lubricated rolling sliding contact fatigue

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Abstract

Pitting is frequently encountered in machine elements, such as bearings, cams and gears, containing parts in relative sliding-rolling motion. Most of investigations on rolling contact fatigue have been carried out by means of numerical/analytical models in the frame of LFEM, but the interpretation of the numerical results is still controversial. The SIFs history is highly non-proportional and the intensity of the peaks is not expected to cause propagation, since they do not exceed the fatigue threshold usually found for long cracks in steels and cast irons. To shed light on this issue, this work is intended to reproduce experimentally the SIF-cycles, estimated by our previous model of RCF crack, by using an alternative non-standard procedure. The novel experimental apparatus is based on the exploitation of a kinked edge crack subjected to a compressive load distributed through the thickness. Changing the load position and intensity permits to induce different values and ratios of SIFs. It has been found that lubricant is strictly necessary to trigger crack propagation, which can be in form either of coplanar extension followed by branching or of branching only. Coplanar extension occurs when mode II SIF range exceeds a certain threshold, well below the typical fatigue threshold. Empirical evidences are in accordance with the tendency of the RCF cracks to do coplanar extension and to branch into the bulk material and toward the surface. Coplanar extension is more pronounced in the interior of the sample, while branching occurs only at the edges. The results indicate that our previous modelling of